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No. 114

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BIOMEDICAL AND BEHAVIORAL SCIENCES

No. 114

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## ECOLOGY

### BIOLOGISTS SEEK WAYS TO AVERT BIODEGRADATION

Moscow PRAVDA in Russian 11 Jun 79 p 3

[Article by Dr Biol Sci, Prof V. Il'ichev, Chairman, USSR Academy of Sciences Scientific Council on Biodegradation: "Biologist Offers Protection"]

[Text] Scientific-technical progress has resulted in many new scientific problems. One of them is biodegradation. Constantly creating new materials and technical devices of ever-increasing complexity, man has now confronted the fact that living nature is destroying his handiwork with ever-greater activity.

Of course the problem is not so new. People have been fighting moths and skin beetles, hull fouling organisms, wood borers, and stone borers for many centuries. But our relationship to organisms that damage the creations of our hands has become qualitatively different. While in former times we simply had to protect our granaries from rodents, now we must also protect our equipment, cables, and much else. As in former times, we must protect woolen and fur clothing from moths, but the "appetites" of the insects have grown, and we must offer protection to synthetic fabrics and plastic articles, to include instruments and protective coatings.

In the early 1950's the world loss stemming from biodegradation was 2 percent of the total industrial production volume; in the 1970's it exceeded 5 percent. In monetary terms this was tens of millions of dollars in developed capitalist countries. However, a significant proportion of the loss does not yield to economic assessment, since living organisms sometimes irreversibly spoil works of art, archival materials, and unique museum exhibits.

The quantity and diversity of materials being created by industry has grown enormously. If they do not contain substances toxic to animals and plants, sooner or later many of them will become the object of attack by living organisms. Thus we must create new materials to replace vulnerable ones, and we must introduce bioresistant components into them. In turn, however, nature commits fresh forces to the battle. This list of organisms that damage materials is quickly growing. They include representatives of practically all taxonomic groups of the organic world.



Not less than 40 percent of the total volume of biodegradation is caused by microorganisms. Bacterial activity alters the hydrocarbon composition of fuel, to form stable slime and emulsions which clog engine filters and pumps. Losses due to corrosion of iron pipes in the USA, elicited by sulfate-reducing bacteria, are valued at \$2 billion per year. Fungi damage glass in optical instruments, polymers, silicates, leather, wood, paper, and stone.

Colonizing the underwater parts of vessels, algae and various mollusks significantly reduce their speed and cause up to a 40 percent rise in fuel consumption. Annual losses in the USA due to fouling of vessels attain \$700 million, while losses in England are 50 million pounds Sterling. But not only vessels are fouled. Living organisms also damage port facilities and clog industrial water pipelines.

World losses due to termites are valued at \$1 billion per year. They are especially great in the tropics. They also inflict considerable losses on the economies of our Central Asian and Transcaucasian republics, damaging wood and wood structures, mineral construction materials, fiberglass fabric, aluminium foil, and porous rubber. The first to suffer in the Ashkhabad earthquake were buildings and structures damaged by termites.

Each year about 4,500 of the world's airplanes and helicopters collide with birds. It is very expensive to repair an aircraft engine damaged by a bird the size of a sparrow. Building nests on electric power line poles and weaving the power lines into them, rooks cause leakage of electric power, and sometimes serious mishaps in the power network. In large southern cities where flocks of birds numbering in the hundreds of thousands spend their winter, their feces eat away at objects of ancient art and elicit accelerated corrosion of iron structures.

The invasion of man's equipment and structures by living organisms is intensifying, and this trend keeps us from counting on solving the problem by just relying on current experience, by present methods for protecting a concrete material from a concrete organism in a strictly defined geographic point.

Two factors--a living organism and a creation of human hands--interact in all situations associated with biodegradation. This provides the grounds for calling the biodegradation problem an ecotechnological one. What we need to study here is the mutual relationships and the interaction of two components--ecological and technological.

What would the national economy gain by solving the biodegradation problem? The life of operated equipment would increase, and industrial structures and art objects would be better preserved. We would be able to economize on materials and make more sensible use of raw materials. Today, for example, our country loses more than 20 million cubic meters of wood each year due to biodegradation. Fungi that attack wood, spoil buildings, bridges, and vessels, and they render railroad ties, telephone and telegraph poles, and

lumber useless. However, our plants do not produce enough antiseptics to protect wood from biodegradation. Nor is there enough equipment with which to impregnate wood, and the network of wood treating stations and plants is insufficiently developed. Wood protection information is still not being disseminated adequately among workers of the appropriate institutions. To compensate for biodegradation losses, we must log an additional 100,000 hectares of forests. If we can find a way to protect the wood, we would be able to preserve these forests.

However, protection of materials and articles from biodegradation is only one side of the problem. Here is the other: The country is becoming littered more and more by materials and articles that have outlived their usefulness, and it is becoming increasingly more difficult to get rid of unneeded rubbish. Creating biologically resistant material and articles, we are obligated to think about their breakdown following their period of useful service. Saprophytic soil fungi, imperfect fungi, and ascomycetes occupy a significant place among microorganisms responsible for biodegradation. In natural conditions they mineralize organic residues. Thus these organisms have already been put to unique use in nature. What we are interested in is to make manmade polymers, biological toxins, and pesticides also susceptible to decomposition by microorganisms, and in preventing them from contaminating the environment. Materials and articles placed in concrete ecological conditions must "work" for a certain pre-established time without being damaged by living organisms, and then they must be broken down and utilized with the help of these living organisms.

Among the protective measures, ecological methods based on a precise knowledge of the way of life and behavior of injurious organisms will apparently be the main ones. First of all we need to clarify what it is in certain materials and articles that attract them. Why do insects crawl into instruments, why do rodents chew insulation, and why do birds nest on radar antennae, on electric power line poles, on bridge girders, and in other places that do not appear to be entirely convenient? Perhaps some properties of the materials and articles recall to them natural factors that are very important to them. Knowing them, we would be able to eliminate them. And not just eliminate them: We would also be able to endow materials and articles with "repellent" properties.

The first international organization on biodegradation was created in 1968, uniting the efforts of representatives from 23 countries--chemists, materials scientists, engineers and, of course, biologists of various specialties.

In our country many scientific and scientific-production organizations belonging to various ministries and departments are working on ways to protect equipment and structures from damage by living organisms. Their efforts are being coordinated by the USSR Academy of Sciences Scientific Council on Biodegradation. All-union conferences and working meetings are being held, monographs, reference materials, and collections are being published, and the appropriate standards are being written. Moscow,



Gor'kiy, and other universities have started training personnel in this specialty. Plans have been made for publishing a "Biodegradation Catalog" in several volumes, which no country in the world has yet, and a museum of cultures of microorganisms responsible for biodegradation. However, all of this is still not enough. The multifaceted problem, which focuses the interests of many sectors of the national economy and science, demands a significantly more sophisticated and powerful system of mutual information and coordination. Our scientific council would be unable to do this through its own efforts. As a result we encounter rampant parallelism in the work of different institutions, and experience accumulated here and abroad is not being utilized because scientists are not always aware of it. Sometimes we employ primitive protective measures, or we simply accept losses due to biodegradation and knowingly suffer tremendous harm. We need a coordination center which would be staffed by qualified experts, and which would contain an experimental base that would allow us to pretest and develop protective methods and bring them to the awareness of representatives from interested departments. As the experience of some foreign countries shows, wherever such centers have been created there are great possibilities for achieving protection from biodegradation, and all outlays on their maintenance are compensated many times over.

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## CONFERENCES

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### CONFERENCE REVIEWS STUDY, PRACTICAL APPLICATION OF MICROELEMENTS

Kiev FIZIOLOGIYA I BIOKHIMIYA KUL'TURNYKH RASTENIY in Russian No 3, 1979  
pp 282-284

[Article by V. A. Kapitanchuk: "The 8th All-Union Conference on the Biological Role of Microelements and Their Application in Agriculture and Medicine"]

[Text] About 500 scientists took part in the conference in Ivano-Frankovsk on 24-27 May 1978. They represented the Academy of Sciences USSR and the academies of the Union republics, scientific research institutions of VASKhNIL [All-Union Academy of Agricultural Sciences imeni Lenin], and higher educational institutions. There were specialists from numerous USSR and Union republic ministries and departments as well as scientists from East Germany, Bulgaria, Poland, and Czechoslovakia. P. D. Sardachuk, secretary of the Ivano-Frankovskaya Oblast party committee, sincerely welcomed the people attending the conference and wished them continued beneficial scientific research on the problem of microelements. He spoke of the past achievements of and future prospects for using microelements in agriculture and medicine in the Subcarpathians and Ukraine.

There were four plenary sessions at which reports were heard on 19 problems. Among the reports were the following: V. V. Koval'skiy (Moscow) — "Current Tasks and Problems of Biogeochemistry," P. A. Vlasyuk with co-authors (Kiev) — "The Participation of Microelements in Plant Metabolism," M. Ya. Shkol'nik (Leningrad) — "The Physiological Causes of Teratological Changes in Plants with Deficiencies and Excesses of Microelements," N. G. Vyrin (Moscow) — "Tasks and Prospects for Development of the Theory of Microelements in Soil Science," G. A. Babenok (Ivano-Frankovsk) — "Metals, Chelating Agents, and Malignant Growth," N. A. Rish (Samarkand) — "Geochemical Animal Ecology and the Problem of Genetics," and V. V. Dobrovol'skiy (Moscow) — "Biogeochemical Aspects of Environmental Contamination by Heavy Metals".

The conference also had meetings of six symposiums with the following titles: "Problems of Biochemistry (Microelements in the Biosphere, Geochemical Ecology)," "The Physiological Role of Microelements in Plant Growing," "The Physiological Role of Microelements in the Animal Organism," "The Physiological Role of Microelements in the Human Organism; Microelements in Medicine," "Microelements in Soil Science and Agrochemistry," and "Methods of Studying Microelements in Biogeochemistry, Soil Science, Plant Raising, Animal Husbandry, and Clinical Medicine." In all more than 400 survey and demonstration reports and communications were presented at the conference. Their basic content was published in "Biologicheskaya Rol' Mikroelementov i Ikh Primeneniye v Sel'skom Khozyaystve i Meditsine" [The Biological Role of Microelements and their Application in Agriculture and Medicine] (Ivano-Frankovsk, 1978).

The results of the conference were summarized at the final plenary session and reflected in the decree adopted, which took note of successes in studying and using microelements in recent years (1975-1978).

Contemporary chemical, polarographic, flame-photometric, and spectrographic methods of analyzing microelements have been greatly refined and material has been accumulated on the distribution of microelements in various plant, animal, and human tissues and the rules governing this distribution.

Research on the structure and functions of metallic ferments and their part in such important life processes as nitrogen fixation, photosynthesis, and nucleic and protein metabolism has advanced. The connection between microelements and processes of growth and development and their role in increasing the resistance of plants and animals to unfavorable external factors affecting their vital activities has been demonstrated. New findings have come in on the physiological role of various microelements such as boron (in the synthesis of nucleic acids and energy metabolism), molybdenum (in biochemical processes of assimilating nitrates), and manganese (in photosynthesis reactions, protein metabolism, converting certain fractions within protein complexes, and localizing and binding it to the cell structures of the plant and activating enzymes). The oxygen reduction vanadium systems have been studied and the role of the cobalt in iodine-containing compounds in animals clarified. New results have been received in research on the interaction of microelements with vitamins, hormones, growth substances, and enzymes and on the role of microelements in increasing plant, animal, and human resistance to illnesses. The great importance of various microelements as medicines for certain illnesses is becoming clear. Broad study of the content and strength of bonding of microelements in organoids of cell structures and their functions have begun. Investigation of the negative role of a surplus of microelements, which is occurring in large, densely populated areas as the result of technogenic environmental contamination, has become extensive. This research is making it possible to disclose the essential characteristics of various endemic human, animal, and plant illnesses and to develop methods of preventing them.

There has been some progress in research to develop criteria of plant requirements for the basic microelements and to work out a system to optimize plant mineral diets. A collection of maps on a scale of 1:5,000,000 showing the content of mobile forms of microelements in the soils of the European USSR has been compiled. Standard samples have been created for three soil blocks (chernozems, noddy-podzolic, and chestnut soils) and three plant groups (wheat, potatoes, and meadow hay) certified by content of microelements.

The broad introduction of microelements in agriculture has shown the wisdom of including rational doses of them in the content of mineral macrofertilizers. At the same time, rational use of microfertilizers has proved quite justified.

Extensive studies by the Institute of Plant Physiology of the Academy of Sciences Ukrainian SSR and other physiological-biochemical institutions concerning microelements in plant life, their effect on various elements of metabolism, and their influence on the structure and functioning of biopolymers have shown the high efficiency of rational use of microelements in growing plants. Study of fertilizers enriched with microelements (superphosphate, nitroammoska and karboammoska) has demonstrated their effect on the yield and quality of the most important agricultural crops. Use of fertilizers with microelements resulted in a 2-8 percent increase in yield of sugar beets and a 0.2-0.7 percent rise in the sugar content of the tubers, which produces a net profit of up to 102 rubles based on yield and up to 360 rubles per hectare based on sugar content. In winter wheat fields the yield gain was 4-5 quintals per hectare with a 1.5-2 percent rise in protein content and 2-4 percent increase in gluten. Each year 37,000-69,000 tons of seed corn in the republic is enriched with microelements at corn-grading plants, which helps increase the yield and productivity of this crop. Scientists have developed a technique for effective application of complexonates of iron and zinc as an important way to control chlorosis in fruit crops. It has been introduced successfully not only in the Ukraine, but also in other Union republics of the southern USSR.

The broad development of studies on copper-containing enzymes and proteins in plants (ascorbatoxydase, phenoloxydase, superoxyddismutase, plastocyanine, and others) was noted. Findings have been obtained on the rules governing change in the significance of certain polyvalent metals in the evolution of the autotrophism of the biosphere. The important role of biogeochemical research on microelement cycles in the biosphere, including all the primary links in their biogenic migration, was emphasized. Research results to clarify the significance of disturbances of microelement metabolism in the etiology and pathogenesis of human illnesses, especially cardiovascular illnesses and malignant tumors, opens new prospects for the use of microelements in medicine to retard the growth of malignant tumors and inhibit other diseases. Rational fluorine treatment of drinking water made possible a significant reduction in the number of caries in teeth. There has not been adequate study of compounds of microelements in soils or of

the physiological-biochemical processes that determine their arrival through root systems. Very few studies have been done of the role of organic matter and soil microorganisms in the formation of compounds of microelements in forms accessible to plants. Research on combined foliar top dressing and insectofungicide and herbicide treatment in crop farming has not developed.

The conference believes it is necessary to expand and deepen comprehensive studies in the field of the physiology and biochemistry of microelements, to investigate their content, localization, and distribution in subcellular structures, and to bolster research on microelements at the molecular level with due regard for the great importance of conditions of synthesis for metal-containing ferments and other biologically active compounds in plant, animal, and human organisms.

A need was acknowledged to continue refining research methods for solving biogeochemical problems and formulating new biomedical experiments in the problem area "The Biological Role of Microelements in the Life of Plants, Animals, and Humans."

The need for further development of more vigorous steps to accelerate the production of experimental industrial batches of fertilizer with different microelement supplements and to study their effectiveness with the primary agricultural crops was emphasized.

The conference recommended that more attention be given to studying the physiological-biochemical role of little-studied microelements such as cadmium, mercury, lead, selenium, bismuth, chromium, tin, silver, fluorine, bromine, arsenic, and others at normal and increased levels in soils and organisms. Crop farming must take account of the soil and agrochemical setting, nutrients, water-air, and heat conditions, specific characteristics of plants, and likelihood of technogenic enrichment of soils with microelements.

It was suggested that specialists of the soil-agrochemical, sanitary hygiene, and hydrometeorological services work out uniform techniques for field research on soil contamination by toxic amounts of elements and modern analytic techniques for analyzing them. A request was submitted through the scientific council on this problem of the Academy of Sciences USSR to coordinate the research of all specialists in the country in order to insure effective protection of the top-soil against technogenic contamination by toxic elements.

A decree was adopted on preparations for and conducting the next, 9th All-Union Conference on Microelements in Kishinev in 1981.

The conference demonstrated the unity of action of the creative community of scientists from various branches of science and outlined a broad program of research. It approved measures for continued introduction of microelements and ultramicroelements in agricultural and medical practice and called on all scientists in the country to give effective help in successfully carrying out the majestic program

outlined by the 25th Congress of the Communist Party of the Soviet Union in the fields of agriculture and public health.

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## FORENSIC PSYCHOLOGY

### PRESSING PROBLEMS IN FORENSIC PSYCHOLOGY

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA in Russian No 5, 1979 pp 76-81

[Article by B. D. Lyskov]

[Text] In the definition given to it by some authors, forensic psychology is presently experiencing a "rebirth." The methodological errors made in the 1920's by some researchers of the causes of crime led, in their time, to abandonment of research in this area. Obviously, we can avoid repetition of such errors only in the event that we clearly define the initial theoretical, methodological, and organizational principles of the development of forensic psychology.

The object of research in forensic psychology is an extremely broad range of psychological problems associated with jurisprudence and legal regulation. Without going into many of the important aspects of the development of forensic psychology presently being discussed in the literature,<sup>1</sup> I would like to dwell on problems concerning analysis of the psychology of criminal behavior, one of the most significant subdivisions of forensic psychology. It is precisely in this area that psychological analyses could, in my opinion, become an important means for raising the effectiveness of crime control measures.

However, the possibilities of modern science in this regard are not being utilized completely today. One of the main causes for this situation is absence of a satisfactory solution to the problems of organizing forensic psychological research, which in turn is associated with inadequate development of some methodological aspects of the crime problem. The most important problem in this regard is that of the relationship between social and biological factors in the psychology of criminal behavior, a problem enjoying active discussion in the legal literature. We cannot fail to note that given the great importance of the debate going on in this connection, its content and form have not experienced any sort of significant changes in the last few decades. As before, relying on a doubtlessly valid definition of crime as a social phenomenon, some authors in principle reject any possibility that the biological (psychophysiological) factor might have a

role of even the slightest importance to explaining the causes of concrete crimes and to revealing the mechanisms of the criminal's behavior. Ignorance of the fact that all social trends are realized only within the actions of concrete people bearing individual psychophysiological features led, in its time, to complete abandonment of research on the criminal personality by psychiatrists and psychologists.

Even today, for practical purposes only representatives of the social sciences, lawyers for the most part, are conducting research on crime and its causes, to include research on the psychology of the criminal personality. In recent years they have published a significant quantity of papers describing research on the criminal personality.<sup>2</sup> However, the content of these papers and the methods used by the authors in their analyses demonstrate that the tendencies of the recent past, when it was believed that "for criminological purposes there is no need for delving into the deep essence of the personality, for seeking biological roots of its behavior, or for clarifying the influence of heredity and the presence or absence of psychopathic symptoms,"<sup>3</sup> have not at all been fully surmounted as yet.

The evolved situation is being criticized by representatives of the opposite extreme: Emphasizing the need for representatives of the natural sciences to participate in the research on the criminological aspect of the biological versus social problem, they attempt to associate crime with the concepts of genetically determined "innate programs of behavior," "social instincts," and so on.<sup>4</sup>

We can hardly raise the productivity of the debate on biological versus social factors in the psychology of criminal behavior without encouraging psychologists--representatives of a science right at the interface of social and biological scientific disciplines--to participate in solution of these problems on a large scale. It should be recognized that given all of the uniqueness and clear antisocial orientation of the criminal's behavior, it is one particular form of behavior in general, and that criminal activity is simply one of the particular forms of human activity. It appears obvious that it would be methodologically incorrect to try to perform a professional scientific analysis of behavior, of the personality's activity (including in the interests of criminology) without the help of representatives in psychology--a science for which the content of these concepts is the principal object of research. In an article such as this, it would be inappropriate to spend a great deal of time proving that modern psychology would be unimaginable without research on namely the deep essence of the personality, including the "biological roots of its behavior" (manifested, naturally, in socially premolded form). The personality is the integral result of all its history, of all past processes, and of all past individual experience. "On the whole it reveals itself in all activity, making itself known in every reaction in all of the history of its past, independent of us and often inaccessible to us," wrote V. N. Myasishchev.<sup>5</sup>

Obviously, we can productively study the psychology of the personality of a criminal (as well as any other person) only on the basis of modern

methodological conceptions of psychological science, utilizing the appropriate arsenal of methods and procedures. Given the increasingly deeper differentiation of knowledge of man, it would be difficult to assume that representatives of criminal law, in their majority (there can obviously be exceptions), have complete facility with the methodology and the concrete methods of personality research. There can only be one answer to the question as to who must study the psychology of the criminal personality. The psychology of the personality must be studied by a professional psychologist. Were anyone else to perform this research, we would end up with only the appearance of having solved the problem. The concrete, practical objectives of such research can and must be spelled out predominantly by representatives of criminal law and criminology, and the research results must naturally "work" in favor of these scientists. But this circumstance does not change the essence of the matter at all.

In principle, there can be no argument that we need to train personnel to conduct extensive research in forensic psychology. The need for this is becoming increasingly more tangible. We need not doubt that in the immediate future, in a society of developed socialism that is building communism, every case of criminal activity will be the object of thorough scientific analysis as an extraordinary phenomenon in conflict with the spirit of socialist social relationships. Nor can there be any doubt that psychological analysis of the mechanisms behind criminal behavior and of the criminal personality will play the leading role in this. It is high time that we begin to treat training of qualified forensic psychologists for these purposes as an important practical task.

Forensic psychological expert examination, viewed as one of the forms of studying the psychology of the criminal personality, can also be said to be experiencing a "rebirth." Its tasks and the limits of its competency are being discussed in the literature. As in relation to forensic psychology as a whole, it is extremely important to determine the paths and perspectives of its development now. Important in this regard is the question as to whether forensic psychological expert examination is developing as an independent organizational form, or whether this development should proceed in close association with the existing system of forensic psychiatric expert examination agencies. Obviously the answer to this question must be predetermined by the nature of the objectives spelled out for forensic psychological and forensic psychiatric research on the personality.

The main task of such research today is, specifically, forensic expert examination in behalf of current jurisprudence. While the expert psychiatrist is summoned for the purposes of answering questions of responsibility or irresponsibility, the conclusions of the expert psychologist serve the purpose of clarifying the legal qualifications behind the actions of the person subjected to examination, and of individualizing the punishment. Obviously these tasks will continue to be fundamental to forensic expert analysis of the psychological state of the defendant (criminal).

An analysis of the content of forensic expert examination by psychiatrists and psychologists and of the organizational and practical problems they face would show that improvements in this work must follow the lines of organizational separation of forensic psychological and forensic psychiatric expert examinations, as well as along the lines of their supplementation, their mutual enrichment by their experience and methods of work, significantly elevating the role of modern psychological methods in all research on the criminal personality.

The following are the most important arguments in favor of this premise. Looking from the historical aspect, we can assume that forensic psychological expert examination of persons committing criminal (socially dangerous) actions came into being simultaneously with forensic psychiatric expert examination, and within its framework. Since the time that forensic psychiatric expert examination was placed on a scientific foundation, presence of mental illness or a temporary mental disorder (the medical criterion of responsibility) had never on its own been recognized to be sufficient for reaching a decision concerning responsibility. The psychological criterion--that is, psychological analysis of the subject's capability for accounting for his actions and controlling them--was the most important, decisive one. This is also the situation today.

Further improvement of the methods for studying the psychological criterion of responsibility of persons suffering mental illness would be unimaginable without more-active participation of psychologists in this work, without their deeper cooperation with psychiatrists. At the same time research on the capacity for maintaining awareness and willfully regulating one's actions in the mentally ill could be performed only with a consideration for the inseparable relationship between the psychological and medical criteria of responsibility. It would be methodologically wrong to consider studying them separately.

It is no less difficult to delimit the spheres of activity (competency) of psychiatric and psychological expert examination in relation to persons suffering so-called borderline states--psychopathies and character accentuations, neuroses, moderate personality alterations accompanying alcoholism and narcomania, alterations occurring after cerebrocranial trauma, and so on. Many prominent researchers have emphasized the significance of various forms of mental pathology defined as borderline states in the origin of criminal behavior. A mental deficiency of this sort "may promote performance of a criminal act, it facilitates its performance, it narrows the possibilities for alternate actions, it sometimes introduces a unique 'motivation' for the act, it reduces the possibilities of self-control, and so on."<sup>6</sup>

Without performing special research, it would be difficult to name the proportion of persons, among those subjected to criminal court proceedings, who suffer some form of borderline psychoneural pathology. However, if we consider that about 90 percent of the persons subjected to forensic psychiatric expert examination (in view of doubt of their mental integrity)



are recognized to be responsible, we would have to agree that there are complete grounds for suggesting that borderline states play a significant role in the origin of criminal behavior.

The medical (psychiatric) and psychological aspects of evaluating the mental activity of persons suffering these states are so closely united that we can insure qualified answers to questions of interest to criminal law and criminology only through the efforts of integrated psychological-psychiatric expert examination. The same can also be said for expert examination of physiological or pathological effects, exceptional states, and so on. The suitability and effectiveness of integrated psychological-psychiatric expert examination in such cases could already be said to be practically demonstrated today. We can only pity the fact that for a number of reasons, including absence of psychologists having competency in the issues of forensic psychology, such expert examination is for the moment extremely rarely requested.

Attempts at delimiting the spheres of activity (competency) of forensic psychological and forensic psychiatric expert examination are leading to a situation in which lawyers are experiencing natural difficulties in resolving the issue as to what sort of expert examination should be requested in each concrete case. This is at a time when psychological expert examination is only just beginning its development. The known organizational difficulties in performing expert examination are one of the main reasons for the fact that mildly pronounced deviations from normal in the behavior of persons suffering borderline states and the initial forms of mental diseases, ones which do not preclude responsibility, are often not felt to be adequate grounds for requesting expert examination. "The existing order for referring defendants for forensic psychiatric expert examination permits discovery of mental diseases that do not preclude responsibility in only a small proportion of persons committing crimes.... Persons guilty of murder under extenuating circumstances are not referred for forensic psychiatric expert examination as a rule."<sup>7</sup> As a result, "the significance of borderline states to criminal law and criminology is not being researched in Soviet legislation, court practice, and science."<sup>8</sup>

Evaluating the perspectives and the most suitable forms of development of forensic expert analysis of the defendant's (criminal's) mental state, we should obviously keep in mind that this entire job will be done in the future in integrated psychological-psychiatric expert examination. With time, presence of an adequate network of agencies responsible for expert examination would make it possible to legalize an order in which referral for expert examination of mental state would be mandatory in all cases of antisocial behavior, in which qualified psychological analysis of the defendant's personality would become a mandatory prerequisite for application of criminal punishment measures or other social sanctions against him. This order, one of scientifically grounded, individualized punishment, would doubtlessly raise its effectiveness, and scientific generalization of expert examination data would permit us to impart a more-purposeful nature to our crime prevention measures.

Discussing the suitability of developing forensic psychological expert examination within the framework of integrated, psychological-psychiatric examination, we need to emphasize the following points having fundamental significance. Transformation of the existing system of forensic psychiatric expert examination into integrated psychological-psychiatric examination should not mean simple inclusion of psychologists into some particular aspects of diagnosing mental illness. What is needed is a significant increase in the role the psychologist plays in determining the psychological criterion of responsibility in the initial stages of mental disease and in the presence of weakly pronounced forms of disease. In expert examination of persons suffering borderline states, meanwhile, psychological analysis of the subject's personality features and the mechanisms of his antisocial behavior must become the principal analysis method.

An expert psychologist working in close contact with psychiatrists must naturally be well trained in medical psychology. One of the ways for solving this problem would be to staff psychological-psychiatric expert examination agencies with graduates of schools and departments of psychology who had received specialized training in medical psychology. In my opinion we should also consider the suitability of providing an abbreviated training program for persons with a higher medical education at schools or courses of advanced training at universities offering specialized courses in medical and forensic psychology.

This discussion does not preclude the possibility and suitability of developing other organizational forms of psychological research in behalf of the fight against crime. In addition to expert examination--that is, provision of direct services to judicial agencies, as I had mentioned earlier, research on the psychology of criminal behavior might play a significant role in revealing the causes of crime. Today, in a time when forensic psychological expert examination has not yet become mandatory in all criminal court cases, psychological research aimed at revealing the causes of crime could be performed by offices (laboratories) of forensic psychology specially created for this purpose. As the first step in this direction, Shlyapochnikov and Dolgova suggest creating experimental institutions of this sort.<sup>9</sup> Given that the forensic psychologist has adequate qualifications in medical psychology, such offices or laboratories could become independent and, in most cases, the sole unit responsible for forensic expert examination of the defendant's mind, calling in an expert psychiatrist only to clarify the medical criterion of responsibility. And so, despite the continuing debate on the relationship between that which is biological and that which is social in the psychology of criminal behavior, we can say that the need for developing forensic psychological research is universally recognized. Obviously, this recognition must be supported by practical steps aimed at organizing such research, and mainly training forensic psychologists.



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## PSYCHOLOGY

### EXPERIENCE IN SYSTEMS DESCRIPTION OF INDIVIDUALITY

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[Article by V. A. Ganzen and L. A. Golovey]

[Text] The development of psychological education in the USSR experienced beginning in 1966, the dramatic rise in the number of psychological specialists, intense development of applied sectors of psychology (such as engineering, medical and social psychology), and the psychological service gradually evolving in our country are making it extremely important to develop psychographic resources which would permit us to effectively solve numerous practical problems. Psychography is a method of synthetic study and description of the individual. Moreover Rybnikov and Anan'yev<sup>1</sup> point out the important significance of psychography to a large number of theoretical subdivisions of psychology and associated disciplines, such as genetic psychology, art psychology, differential psychology, and so on. Practical psychologists and educators are now experiencing a special need for developed forms of psychography.

The psychography problem is not new; its existence was recognized long ago, and several attempts have been made at its solution. Stern<sup>2</sup> was one of the first to employ psychographic description as a way to study individual psychological differences between people. In order to arrive at a classification of people, Lazurskiy developed a personality research program<sup>3</sup> having the elements of systems theory. In 1920 Rybnikov published his "Biographies and Their Analysis."<sup>4</sup> He writes that in order to impart the nature of a system to a description of an individual, we would need a chart bearing a list of all of the most important traits and properties of significance to analyzing individuality. Such a "psychological chart," or "psychogram," is a unique sort of psychological photograph. In his work, Rybnikov describes attempts at compiling such psychograms by researchers such as A. Binet and C. Heymans. Toulouse's attempt at writing Emile Zola's biography is especially complete in its methods. In 1924 Kolodnaya attempted to compile psychographs, placing the accent on their biographical aspect.<sup>5</sup>

All of the works cited above are predominantly descriptive, they contain little experimental material, and in a number of cases they are limited solely to analysis of biographical literature (as for example with Heymans).

To solve applied problems Platonov compiled a psychological chart of the student personality, to be used by educators.<sup>6</sup> He provides several variants of his chart in application to different tasks (full psychological description, and special-purpose psychological description).

Anan'yev's approach differs from all preceding ones in that he interprets psychography as a method of integral synthetic study of man as an individual, a personality, a subject of activity, and an individuality. Psychographs began to be compiled in 1964 at the Laboratory of Differential Psychology and Anthropology imeni B. G. Anan'yev. This approach was used in works by Loginova and Vladimirova.<sup>7</sup> Anan'yev included the following basic aspects in his psychographic analysis. The life history, description of the individuality on the basis of experimental data, the observation method, natural experimentation, and analysis of the product of activity; analysis and prognosis of the individuality's development. In this case he felt that a full description could be arrived at only by combining the methods of cross and longitudinal sections. His psychogram is the result of applying the psychographic method.

A psychogram of this volume contains a large amount of information that must be placed into a form convenient for its use. Thus we must concern ourselves not only with its content but also with the form in which it is presented to the user, with systematizing diverse data describing the individual. Psychograms can be used by educators, physicians, practical psychologists, and production collective executives. However, it should be emphasized that only college-trained specialists in psychology may compile psychograms. The objective of this paper is to suggest one of the possible forms of a psychogram based on the systems approach.

Let us spell out the basic requirements that a psychogram must satisfy:

1. Integrity, which presupposes unification of all data about the individuality, irrespective of the methods with which they are obtained.
2. Differentiation, which means that the psychogram allows us to add further detail to the description of the individuality, which is a constant need due to the continuing development of methods for studying the personality.
3. Openness. This requirement on psychographic description means that the psychogram must permit inclusion of all new data.
4. Stability, meaning inclusion, in the psychogram, of only those characteristics which would reflect the most stable traits and properties of the given individual.
5. Dependability, which is insured by choosing valid analysis methods.
6. Convenience of practical use.

7. A single format for cross and longitudinal description and for description of state dynamics.

8. Completeness, which is mainly predicated by Anan'yev's conception of man as an individual, a subject of activity, a personality, and an individuality. Completeness also means considering that which is individual and that which is special. That which is special is accounted for through the use of in the psychogram which define the subject's place in the society at large. Completeness is insured by considering not only amplitude characteristics but also the relationships among them, both external-internal and internal-internal on one hand, and internal-external on the other. We satisfy the completeness requirement by describing the individual level by level.

We attempted to set up a psychogram reference grid (see Figure) in which the horizontal lines I, III, V, and VII correspond to the principal level of analysis (genetic, physiological, psychological, and social). In addition to these levels, which are said to be basic in the literature, we distinguished intermediate levels--morphological, psychophysiological, and psychosocial (II, IV, VI). The braces on the left of the figure encompass levels pertaining to individual, subjective, and personal characteristics of the individual. Now we draw a number of vertical lines intersecting the resulting system of horizontal lines. They are designated in the figure by arabic numbers and letters. Each of these vertical lines corresponds to one of the important characteristics of the individual. These characteristics are arranged from left to right in order of their decreasing generality. We call the resulting system of horizontal and vertical lines the psychographic grid. The points where horizontal and vertical lines cross are called the psychographic grid junctions, and it is at these junctions that primary empirical information is concentrated. This information is generalized in relation to the horizontals and verticals in the form of generalized characteristics of the individual, which are arranged in the figure to the right of the horizontal lines and below the vertical lines. By arranging empirical information on the individual compactly in the form of such a psychographic grid, we are able to systematize this information, make a quick assessment of individual characteristics typified by different degrees of generality, and reveal areas in which information is incomplete. Junctions in the psychographic grid are designated by symbols of two types: ●--information available at the given moment; ○--information that could be acquired but which is not available at the given moment. The resulting system of labeled horizontal and vertical lines--the psychographic grid--serves as the basis of the psychogram.

The structure of the psychographic grid determines the relationship between individual characteristics, which can in turn be inspected along the verticals and along the horizontals, and between the verticals and horizontals. Using these general characteristics as the basis, we arrive at a general psychological description of the individuality and predict its development.

In its cross section, the psychogram as a whole must contain the following parts: A--basic questionnaire data; B--the psychographic grid;





Key:

- |  |   |
|--|---|
| 1. Levels  | 34. Motor functions                                 |
| 2. Social  | 35. Speech  |
| 3. Psychosocial  | 36. Thinking  |
| 4. Psychological                                       | 37. Volition  |
| 5. Psychophysiological                                 | 38. Memory  |
| 6. Physiological                                       | 39. Attention                                       |
| 7. Morphological                                       | 40. Uniqueness of the individuality                 |
| 8. Genetic   | 41. Dominant tendencies                             |
| 9. Statuses  | 42. Level of potentials                             |
| 10. Roles  | 43. Dominant orientation                            |
| 11. Relationship between reflection and transformation | 44. Level of general and special capabilities       |
| 12. Survival   | 45. Key traits                                      |
| 13. Viability  | 46. Type of temperament                             |
| 14. Type of constitution (in the broad sense)          | 47. Level   |
| 15. Hereditary characteristics                         | 48. Dominant  |
| 16. Individuality                                      | 49. Dominant state                                  |
| 17. Tendencies   | 50. Level of development                            |
| 18. Potentials   | 51. Type of structure                               |
| 19. Orientation  | 52. Activity-reactivity                             |
| 20. Capabilities                                       | 53. Type of relationships                           |
| 21. Character  | 54. General sensitivity, dominant sensitivity       |
| 22. Temperament  | 55. Integrity, maintenance of structure, constancy  |
| 23. Processes  | 56. Clarity, generality                             |
| 24. Properties   | 57. Emotionality, its sign                          |
| 25. States   | 58. Level of development, strength, rate, precision |
| 26. Functions  | 59. Descriptive, logical                            |
| 27. Structure  | 60. Analysis-synthesis                              |
| 28. Activity   | 61. Strength of will                                |
| 29. Relationships                                      | 62. Level and structure                             |
| 30. Sensation  |   |
| 31. Perception   |   |
| 32. Imagination  |   |
| 33. Emotions   |   |

C--explanation of the junctions; D--particular conclusions from the verticals and horizontal; E--general conclusion and prognosis.

Experiments performed by students as part of their academic work at the LGU [Leningrad State University] school of psychology in 1978 provided the material for the psychogram. Students enrolled in the school served as the subjects. The following example is the psychogram for coed K. Experimental data are presented in the order of increasing generality of characteristics.

The description contains raw experimental data in the following order--characteristic under analysis, analysis procedure, unit of measurement,



empirical data, conclusion. In terms of spatial arrangement, this information is concentrated in the psychogram at its junctions. Then follow a generalization of the data and a conclusion based on the vertical and the horizontal lines, an analysis of all acquired data, a general conclusion, and a prognosis (of development and activity). For practical purposes we use not only information contained in the analysis and prognosis but also in descriptions of each junction, vertical line, and horizontal line.

Let us continue the description of the psychogram with a concrete example of a cross section psychogram. Here are parts B, C, D, and E of the psychogram.

IV - 10a. Vibration sensitivity, in db:

16 Hz	32 Hz	63 Hz	125 Hz
0.8	9.3	8.9	4.8

Conclusion: High sensitivity.

Thermal Sensitivity: The increase in intensity of a thermal stimulus necessary for threshold sensation is, in degrees:

	Left temple	Fore-head	Right temple	Left hand	Right hand
Warm . . . . .	0.8	1.4	1.5	2.2	3.0
Hot . . . . .	3.4	4.7	5.0	8.1	8.5
Painful . . . .	7.4	8.5	8.6	12.6	12.2

Conclusion: Thermal sensitivity is above average.

IV - 10d. Tremometry, Mede's Tremometer, adjustable tremor: Left hand--2.4 Hz, right hand--0.8 Hz. Sweating, Mishchuk's instrument; right hand--600 kohms, which corresponds to 6 points (the scale was devised by K. D. Shafranskaya).

Conclusion: Average emotional excitability.

V - 10d. Spilberger-Khanin questionnaire, 42 points, which corresponds to the upper boundary of normal. Cattell's personality inventory: Score for factor C--9 points; scores for secondary factors: I--8 points, III--3 points;

these scores attest to high emotionality and anxiety; Lyusher's method revealed high emotionality and sensitivity.

VI - 10d. Rosenzweig's technique:

	O-D	E-D	NP	$\Sigma$	%
E	5,5	4,5	6,0	16	66,6
G	1,0	1,0	2,5	4,5	78,1
M	1,5	2,0	—	3,5	14,6
$\Sigma$	8,0	7,5	8,5	GCR = 33%	
%	33,3	31,2	35,4	for example: NP > O-D-E-D	

Conclusion: Outward accusatory reactions dominate (reproaches external conditions for injustice more than herself), and the group adaptation factor is low.

10d. Average emotional excitability at the psychophysiological level; high emotionality and anxiety at the psychological level; low group adaptation.

III - 10e. Hand strength, Kolen's dynamometer: Right hand strength--18 kg; left hand strength--17 kg; standing strength, spring dynamometer--55 kg. Overall physical development is below developmental norm.

IV - 10e. Tremometry, static tremor, Mede's tremometer, dynamic tremor, linear maze:

(1) Тремор статич.		(2) Правая рука		(3) Левая рука	
(4)	Амплитуда, мм	2,0	2,5	2,0	2,5
(5)	Кол-во касаний	12,0	4,0	35,0	5,0
(6)	Тремор динам.				
(7)	Время, с	9,0		7,0	
(5)	Кол-во касаний	18,0		15,0	

Key:

- |                  |                       |
|------------------|-----------------------|
| 1. Static tremor | 5. Number of Contacts |
| 2. Right hand    | 6. Dynamic tremor     |
| 3. Left hand     | 7. Time, sec          |
| 4. Amplitude, mm |                       |

Conclusion: Good movement coordination, good rate and precision qualities.

10e. High rate and precision qualities coupled with a certain deficiency in physical development.

V-10f, 10f. Free association method--large active vocabulary, high generality and stability of speech.

V-10g. Gilford's technique: Logical thinking (LT)--5-24 points, LT--7-28 points, LT--9-26 points; descriptive thinking (DT)--18 points.

Conclusion: Average, below average for descriptive thinking.

Wechsler's method:

Subtest number	1	2	3	4	5	6	7	8	9	10	11
Scores (points)	15	19	13	12	10	15	10	8	10	9	3

The score for general intelligence is 113, the score for verbal intelligence is 129, and the score for nonverbal intelligence is 90.

The score for general intelligence is good; the difference between verbal and nonverbal intelligence (the intelligent gradient) is high due to low scores for nonverbal intelligence and rather high scores for verbal intelligence. The subject is especially successful in subtests of general awareness and comprehension. Scores were lowest for subtests 8, 9, 10, and 11, which require highly developed attention and descriptive thinking.

10g. Good on the whole, with very high verbal and low nonverbal intelligence.

V-10i. Short-term memory: For syllables--25.2, for words--81.2, for acoustically presented material; visual memory for syllables--42.4, for words--56.5. Long-term memory: Memorization of words--34.0, of syllables--20.0; retention of syllables--48.0, of words--59.0.

V-10i, 10i. Good short-term memory, below average long-term memory.

V-10j. Attention span, Schulte's method, score--15 points: large attention span. Attention switching, Gorbov-Schulte tables, score--6 points: Switching below average. Attention selectivity, Munsterberg's test, score--18: High selectivity. Attention stability--Kraepelin's test, score--41, which corresponds to high stability.<sup>8</sup>

V-10j, 10j. High attention span, selectivity, and stability, low attention switching capability.

III - 7a. The intensity of metabolic processes was determined with Reid's formula: Basal metabolism is 8, 9, which corresponds to an average metabolic rate.

Hemodynamic characteristics: Pulse--80 strokes per minute, arterial pressure--110/70. Strength tests revealed low endurance.

IV - 4d. Expressiveness of the law of strength: Reaction to intense and weak sounds (400 and 100 db respectively), and the ratio of the latent periods for intense and weak sounds is 0.9, which corresponds to a tendency toward a weakly excitable nervous system. Critical flicker-fusion frequency--average, monocular, 40.1 Hz = 7 points--high nervous system lability. The Myra-Lopez graphic technique revealed dominance of inhibitory processes over stimulatory processes.

V - 4d: Eysenck's technique: Extraversion--11, neuroticism--18, deceit--3; a tendency toward introversion, somewhat high neuroticism.

4d. According to the results of all tests, subject possesses a melancholic temperament.

V - 4c: Cattell's personality inventory:

A	B	C	E	F	G	H	I	Z	M	N	O	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>
4	10	6	2	4	8	4	6	6	8	1	8	9	4	4	9

Secondary factors: I--8, II--3, IV--6.

Conclusion: High capability for logical abstraction, learns well, has a critical predisposition, thinks analytically, tries to be well informed, readily accepts unorthodox viewpoints. Stubborn, willfull, responsible, exhibits a high need for activity. Anxious, frustrated, restless, irritable. Conformist, dependent on other people, longs to communicate, but her high anxiety, introversion, and high self-assessment hinder free communication. All of this creates discomfort, since the subject longs for communication but is unable to achieve it, exhibiting a tendency to deepen the conflict further. The Myra-Lopez method and Lyusher's method revealed a tendency toward low vital tone, a desire for peace, a feeling of helplessness, and a certain degree of depression.

4c. High emotionality in the presence of well developed volition, introversion, and a high self-assessment hindering communication.

V - 4b. Cattell's method: High capabilities for logical abstraction, good ability to learn. Wechsler's method indicates very high verbal intelligence but low nonverbal intelligence.

4b. Possesses good mental capabilities in the presence of a disproportion between verbal and nonverbal levels.

VI - 4a. Volkova's method and Cattell's method revealed a strong orientation toward mental activity, toward the self, and a desire for communication; highly active in educational and social areas, with a pronounced need for self-assertion being the motive force.

Potentials, tendencies, and individuality are described on the basis of all of the experimental material presented earlier, with the addition of sociometric data and questionnaire responses by teachers and class friends. In this case we generalize the data along the horizontals.

III - 2b. The characteristics of metabolic processes and hemodynamics attest to low adaptivity and low endurance in the presence of a load.

IV - 2b. High emotionality, low development of the psychophysiological substrates of volition, weak arousal.

V - 2b. High level of speech development, motor functions, and verbal intelligence; well developed volitional qualities, high attention span and selectivity, good short-term memory. High academic successfulness. Low nonverbal intelligence, low capacity for attention switching, low development of long-term memory.

2b. Natural potentials are not very high; however, traits of character that had been developed in early training, such as stubbornness, will, and a responsible attitude toward work, promoted development of verbal functions, which make high academic success possible.

VI - 2a. Social status as determined by sociometry in the study group:

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Intimate-Emotional Sphere	Academic Status	Work Status	Interesting Person
1.15	4.0	1.2	1.3

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Conclusion: Low social status in relation to all parameters of communication, except for academic.

V - 2a. Three basic tendencies were revealed--for communication, for cognitive activity, and for self-assertion.

1. The principal characteristics of individuality are:

V. Relationships between tendencies and potentials. While natural potentials are not very high, there is a strongly pronounced tendency toward self-assertion and an inflated self-assessment, which creates one of the significant conflicts of the given individuality.

There is a strongly pronounced tendency toward communication coupled with presence of high egocentricity, which creates a second conflict for the given individual.

Prognosis: Guidance, small loads, and information comprehension requiring limited communication and accompanied by successive documentation of the results of activity are recommended. If activity is organized in this fashion, high professional results will be insured.

When the conditions of activity become more complex, causing aggravation of the existing conflicts, the following may be possible: first, deepening of conflict going as far as development of neurosis; second, reduction of vital tone (a tendency for this already exists), a decrease in exactingness toward the self and, as a result of this, reduction in the individual's potentials.

This example was taken from the experience of concrete research; it provides an incomplete description of the cross section, and from it we can clearly see the lacking components of the description.

This example reflects only some aspects of the person as an individual, a subject of activity, a personality, and an individuality; characteristics of mental development are not reflected sufficiently, which can be explained by the incompleteness of experimental material supporting this example.

Subsequent improvements in the use of the psychographic method would include selection of a necessary and sufficient system of methods, and development of different variants of this psychogram for different users.

The principles followed in construction of the psychographic grid are adequate to the existing empirical material. They may also be utilized in description of the longitudinal section of the development of a person's individuality and his life's path, in repeat examinations, and in examination of behavior in extreme conditions.

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## PUBLICATIONS

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### GAS LASERS IN EXPERIMENTAL AND CLINICAL ONCOLOGY

Leningrad VOPROSY ONKOLOGII in Russian No 4, 1979 signed to press 27 Mar 79  
pp 86-87

[Review by A. P. Kozlov and K. G. Moskalik of book "Gazovyye lazery v Eksperimental'noy i Klinicheskoy Onkologii" by S. D. Pletnev, N. D. Devyatkov, et al, "Meditsina", Moscow, 1978]

[Text] The first lasers were developed not more than 15 years ago. However, within this comparatively short period of time, laser emission, which possesses some unique properties, has been used extensively in different regions of science and technology. There are attempts to use laser radiation in biology and medicine and such attempts are completely appropriate. The urgency of the problem of the struggle against malignant neoplasms has provided impetus to the study of the possibility of use of lasers in oncology. There are already some summary studies of foreign and domestic authors involving the analysis of results of experimental and clinical study of the antitumoral effect of pulsed laser radiation. This book is, in essence, the first book which contains a generalization of data from the literature and data from the years of experience of the authors in the use in oncology of another form of laser radiation, emissions of continuous gas lasers.

The book consists of a forward, 6 chapters, a conclusion and a bibliographic index of domestic and foreign literature. The first chapter describes the characteristics of laser radiation and presents an examination of the principles of action and the apparatus of some gas lasers.

Chapter 2 presents general information concerning the use of lasers in biology and medicine. It presents data concerning results of the interaction of laser radiation and biological objects, occurring at the cellular and subcellular level. The opinion of the authors that, with time, significant successes in the study of cancer and hereditary diseases will be achieved with the help of laser beams which permit a selective effect on these or those structural elements of the cell and also directed change of the course of chemical processes in tissue, commands respect.

The problem of the interaction of laser emission and biological objects at the tissue level is the topic of the next chapter of the book. Here the authors dwell upon morphological changes which rise in the tissue, radiated by high energy laser radiation and also present their own data concerning the effect of low power emission of continuous action lasers on the skin and underlying tissue and tumors in laboratory animals. It is pointed out that the nature and degree of pronouncement of biological effect depends on the wave length of the beam, the dose and method of radiation. These facts indicate the difference in the effect of different forms of laser emission on biological objects.

Chapter 4 contains a description of the effect of high energy radiation of a carbon dioxide laser on tumors in experiment and in the clinic. It presents a detailed discussion of procedures for irradiating neoplasms by a defocused beam (laser therapy) and by a moderately focused beam of a laser (laser coagulation). The chapter also presents doses of laser radiation necessary for complete destruction of the tumor.

The methodological problems of the use of laser radiation in the oncological clinic described in this chapter were worked out by the authors in experiment and the results are presented in this section of the book. In the conclusion of the chapter, there is a discussion of the authors' own data of treatment by a CO<sub>2</sub> laser beam of plane cellular skin cancer in man and also of melanomas and their intracutaneous metastases. The number and the courses of observation gave the authors a basis to assume that continuous laser emission is an effective means of struggle with one of the dangerous enemies of man (malignant neoplasms) and may be used with success both independently and in combination with traditional methods of treatment of tumors of the integument.

The monograph also contains a chapter presenting a discussion of problems concerning the use in experiment and in the oncological clinic of a focused gas laser beam as a "laser scalpel." With the help of radiation from a CO<sub>2</sub> laser, the authors have performed many operations on animals to dissect soft tissues, to amputate extremities, to resect internal organs and to resect tumors. They conducted parallel pathomorphological study of the tissues in different periods after surgical intervention. Optimal parameters of laser radiation necessary for its use in the form of a "light scalpel" were determined. Experiments involving removal of experimental tumors showed the advantages of a laser beam over a scalpel and an electric knife due to the small amount of bleeding of the wound surface and the ablaticity and sterility of the surgical wound. After experimental approval, the "laser scalpel" was used successfully by the authors to remove skin tumors in man.

The last chapter of the book describes the measures required for laser surgery and presents a system of measures for protection of medical personnel and

the patient from the harmful effect of laser emissions. The book concludes with the optimistic statement that, in the near future, the laser beam will restore thousands of persons to health.

The monograph contains 55 illustrations, most of which are photographs of micro-preparations and macro-preparations and some show patients with tumors subjected to laser therapy. Most of the drawings are well prepared and highly informative.

We must point out the misprint in the last paragraph of the first chapter "radiation therapy" and to the ambiguity of identification of one and the same groups of animals in Table 6 and Figure 12. It would be more appropriate to use the term "laser scalpel" instead of the term "radiation scalpel." Moreover, we do not share the authors' opinion (also held by individual researchers) concerning the fact that the use of high-energy pulsed radiation in oncology is fraught with the danger of dissemination of blastomic cells by introduction of them into surrounding healthy tissue, the lymph vessels and the blood vessels at the moment of irradiation. In spite of the fact that pulsed lasers produce a thermal effect and possess an inherent dynamic effect, there are no convincing data of either an experimental or of a clinical nature in the literature which indicates the spread of the tumoral processes under the effect of pulsed laser radiation.

In spite of these shortcomings, the book is very interesting and, doubtless, will be useful for oncologists, surgeons and dermatologists.

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ANNIVERSARY REVIEW OF CAREER OF KUYBYSHEV PHYSIOLOGIST M. V. SERGIYEVSKIY

Leningrad FIZIOLOGICHESKIY ZHURNAL in Russian No 5, 1979 pp 780-781

[Anniversary article by N. A. Merkulova, G. I. Kositskiy, L. N. Zefirov, R. Sh. Gabdrakhmanov, and V. Ye. Yakunin: "Mikhail Vasil'yevich Sergiyevskiy — on His 80th Birthday and 52nd Year of Scientific, Pedagogical, and Public Work"]

[Text] On 27 October 1978 Mikhail Vasil'yevich Sergiyevskiy, outstanding Soviet physiologist, celebrated his 80th birthday and 52nd year of scientific, teaching, and public work.

M. V. Sergiyevskiy began his scientific activity under the direct guidance of the noted Kazan' physiologist N. A. Mislavskiy. In 1936 Mikhail Vasil'yevich Sergiyevskiy became head of the department of normal physiology at the Kuybyshev Medical Institute and for many years also headed the department of physiology and psychology at the Kuybyshev Pedagogical Institute.

M. V. Sergiyevskiy began to reveal his talent as a scientist and teacher from the moment that he became head of the department of normal physiology at the Medical Institute. In the department M. V. Sergiyevskiy and his numerous students and associates creatively elaborated N. A. Mislavskiy's ideas on the location and structure of the respiratory center and began studies of the mechanism of reflex regulation of breathing and blood pressure, which produced rich factual material for a radical revision of theoretical ideas on the regulation of breathing and blood circulation.

Mikhail Vasil'yevich summarized these studies in the monograph "Dykhatel'nyy Tsentr" [The Respiratory Center] (1950). This was a major contribution to both domestic and world science.

His multifaceted talent, profound knowledge, and encyclopedic erudition enabled Mikhail Vasil'yevich to advance and successfully develop the theory of the importance of the upper parts of the brain in regulation of breathing, to formulate the idea of mobile functional constellations

or associations with nerve centers which regulate the activity of various functional systems simultaneously or in series.

He also conducted an analysis of the comparative excitability of respiratory reactions with irritation of the carotid sinuses, medulla oblongata, and upper regions of the cerebral cortex. He considered typical characteristics of breathing from an age point of view in healthy people and during various illnesses. He has studied and is still studying the genesis of the rhythm of the respiratory center.

A second significant group of studies was devoted to peripheral or local reflexes.

He established the possibility of reflex reactions by the vascular system to the activity of various organs of the small pelvis and abdominal cavity.

These studies formed the subject of the monograph "Perifericheskiye Refleksy" [Peripheral Reflexes] (1964).

A third group of studies was carried out during the Great Patriotic War on the mechanisms of formation of traumatic shock.

A simplified method of analyzing types of higher nerve activity suitable for application in teaching and medical practice was developed under the direction of M. V. Sergiyevskiy.

In recent years he and his associates have devoted their primary attention to the characteristics of functional organization of the respiratory center and integration of the activities of the respiratory and cardiovascular functional systems. New evidence is being found that the medial zone of the respiratory center chiefly receives afferent impulses and integrates them. They made the remarkable discovery that there are special inspiratory and expiratory places whose stimulation leads to inspiration or expiration with amazing regularity.

This research should be considered an important new stage in revealing the intimate nature of the origin of the rhythm of the respiratory center. Mikhail Vasil'yevich has been able to involve dozens of scientific associates in his research.

In the period between 1936 and 1978 15 doctoral dissertations and 60 candidate's dissertations have been performed. His inexhaustible energy has enabled Mikhail Vasil'yevich to create a major scientific center in the physiology of respiration in the city on the Volga, Kuybyshev.

At the present time three departments of physiology at three higher educational institutions in Kuybyshev (the State University and the medical and pedagogical institutes) are headed by representatives of the Kuybyshev school of physiologists.



M. V. Sergiyevskiy is a brilliant lecturer and teacher who enjoys the love and respect of his associates and fellow teachers. There is another characteristic of Mikhail Vasil'yevich that attracts attention; he always takes an active part in public life. M. V. Sergiyevskiy was one of the initiators and organizers of the Volga Congress of Physiologists, Biochemists, and Pharmacologists in 1947, the Volga conferences of physiologists (1957 in Kuybyshev, 1960 in Kazan', 1963 in Kuybyshev, 1960 and Kazan', 1963 in Gor'kiy, 1967 in Saratov, 1969 in Yaroslavl', 1973 in Cheboksary, and 1975 in Vladimir), and all-Union symposiums on respiratory problems (1967 in Astrakhan' and 1968 in Kuybyshev). At the present time M. V. Sergiyevskiy is actively organizing the 8th Volga Conference of Physiologists.

M. V. Sergiyevskiy has been chairman of the Kuybyshev Division of the All-Union Society of Physiologists imeni I. P. Pavlov and chairman of the Volga Association of Divisions of the All-Union Physiological Society without a break since 1936.

M. V. Sergiyevskiy has taken an active part in various international congresses of physiologists (Leningrad, Montreal, Tokyo, and Prague).

Mikhail Vasil'yevich has been elected a deputy to the Kuybyshevskaya Oblast Council of Worker Deputies three times.

The Soviet Government showed its high respect for the work of M. V. Sergiyevskiy by awarding the Order of the Labor Red Banner and various medals.

M. V. Sergiyevskiy is full of creative strength and energy. We wish him good health and continued creative successes on behalf of our Soviet science.

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OBITUARY FOR SVERDLOVSK PHYSIOLOGIST P. F. SOLDATENKOV

Leningrad FIZIOLOGICHESKIY ZHURNAL in Russian No 5, 1979 p 781

[Obituary by "a group of comrades": "P. F. Soldatenkov"]

[Text] Petr Fedorovich Soldatenkov, head of the department of physiology and biochemistry at Sverdlovsk Agricultural Institute, professor, doctor of biological sciences, Honored Scientist of the RSFSR, member of the CPSU since 1930, and veteran of the Great Patriotic War, passed on unexpectedly in his 74th year.

For 30 years Petr Fedorovich headed the department, brilliantly combining teaching work with research. He knew what the students cared about and generously shared his experience and knowledge. More than 40 candidates and doctors of sciences trained by Petr Fedorovich are now working at the educational and scientific research institutions of our country.

Soldatenkov's research in physiology is well-known and dealt with timely problems of animal husbandry and veterinary science. He was directing studies being conducted at kolkhozes and sovkhoses until the final days of his life, and he offered considerable practical help to agricultural specialists.

Petr Fedorovich Soldatenkov always found time to perform public work also. He was elected a deputy to the Sverdlovskaya Oblast Soviet and served as a member of specialized councils for the defense of candidate's and doctoral dissertations, member of the Consolidated Scientific Council on the Problem of Human and Animal Physiology of the Institute imeni I. P. Pavlov of the Academy of Sciences USSR, chairman of the Sverdlovsk Division of the All-Union Physiological Society, and propagandist for the philosophical seminar.

For his military labor during the Great Patriotic War and his long years of scientific, teaching, and public activities P. F. Soldatenkov was awarded the Order of the Patriotic War 2nd Degree, the Order of the Red Star, the Order of the Labor Red Banner, the Badge of Honor Order, and numerous medals.

We have lost a man of great and generous soul, a high-principled communist, and an important scientist.

The human kindness and shining talent of Petr Fedorovich will live on in our hearts for many years and his scientific heritage will always remain a part of physiological science.

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## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### OBITUARY FOR N. A. ROKOTOVA, PHYSIOLOGIST OF MOVEMENT

Leningrad FIZIOLOGICHESKIY ZHURNAL in Russian No 5, 1979 p 782

[Obituary by the editorial board: "In Memory of a Comrade"]

[Text] On 31 October 1977 Professor Nina Aleksandrovna Rokotova, a member of the editorial board of this journal, prominent scientist, head of the laboratory of the physiology of movement at the Institute of Physiology imeni I. P. Pavlov of the Academy of Sciences USSR, and doctor of biological sciences, died unexpectedly.

Nina Aleksandrovna began her scientific career before the Great Patriotic War with work in the field of aviation medicine. She went to the front as a volunteer in the very first days of the war and spent the entire war working in a long-range bomber aviation regiment. Her interest in the problem of the physiology of movement began to take shape in Koltushy in 1949.

N. A. Rokotova's scientific views and philosophy formed under the influence of such major physiologists as L. A. Orbeli, N. A. Bernshteyn, and K. M. Bykov. Nina Aleksandrovna became head of the scientific collective of the laboratory of the physiology of movement in 1960.

Nina Aleksandrovna was one of the pioneers in the cybernetic approach to the study of biological systems. Her writings in the period 1960-1975 show her to be a specialist in the physiology of movement, neurophysiology, human factors engineering, and the physiology of higher nervous activity. The profound and succinct analysis of the basic ideas of the working principles of the whole brain as the controlling element in a controlled system, set forth in the first chapter of her monograph "Motornyye Zadachi i Ispolnitel'naya Deyatel'nost'" [Motor Problems and Performance] (Izdatel'stvo Nauka, Leningrad, 1971) was a notable contribution to this long-standing dispute.

Beginning her own research with an analysis of complex forms of animal behavior and the work of human operators, Nina Aleksandrovna did not stop at postulating hypothetical control blocks in the central nervous

system, but rather tried to identify the concrete mechanisms behind the regulation of movement at different levels: system, spinal, and neuronal. Beginning from the idea that sensory inputs, in particular the proprioceptive afferent system, have a particularly important part in controlling precise movements, N. A. Rokotova had recently begun decoding the mechanism behind deliberate control of muscular effort. For this purpose the laboratory began studies on muscle physiology, the functions of the proprioceptors, and modeling the spinal level of control in addition to behavioral tests (human operators and chronic animal tests). The comprehensive approach to solving this problem was, as N. A. Rokotova saw it, the way to solve other timely questions of the physiology of movement.

Nina Aleksandrovna took part in organizing many USSR and international symposiums and conferences and worked hard on the editorial board of the Physiological Journal of the USSR.

Prominent scientist and active public figure on the one hand, and charming woman, fine comrade, kind and sincere human being, and CPSU member — that is how Nina Aleksandrovna Rokotova will be remembered by her many students, colleagues, and friends for many long years.

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## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

UDC 616-006 (092 Bogovskiy)

PAVEL ALEKSANDROVICH BOGOVSKIY (On His 60th Birthday)

Leningrad VOPROSY ONKOLOGII in Russian No 4, 1979, pp 89-90

[Article by All-Union Scientific Society of Oncologists, ESSR, Ministry of Public Health Institute of Experimental and Clinical Medicine ESSR Republican Scientific-Medical Society of Pathologoanatomists, Editorial Board of the Journal "Problems of Oncology."]

[Text] Pavel Aleksandrovich Bogovskiy, Corresponding Member of the USSR Academy of Medical Sciences, Honored Scientist of the Estonian SSR, commemorated his 60th birthday on 10 March 1979. He was born into the family of a physician in the town of Tartu where he completed grammar school. In 1937, he enrolled at the Tartu University Department of Medicine. In 1943, he completed studies at the Department of Medicine at the Kazakh Medical Institute. He served as a military physician until the end of World War II. After demobilization, he became a graduate student studying pathological anatomy and he defended his candidate's dissertation in 1949. In the same year, he began work at the ESSR Ministry of Public Health Institute of Experimental and Clinical Medicine. He has served as director of this institute since 1953.



In 1961, P.A. Bogovskiy defended his doctoral dissertation "The Carcinogenic Effect of Products of Estonian Shale Processing." In 1962, he was granted the title "Professor" and, in 1965, he became a Corresponding Member of the USSR Academy of Medical Sciences.



Professor P.A. Bogovskiy is the founder of experimental oncology in Estonia. His studies of the carcinogenic properties of products of thermolysis of fuel shales is closely interwoven with studies in industrial pathology and labor hygiene, conducted by the institute in the shale basin. Bogovskiy's studies provided the basis for development of measures for prevention of occupational cancer. Data relative to this problem were published by him in the monographs "Occupational Cancers of the Skin, Caused by Products of Processing Fuel Minerals" (1960) and "The Carcinogenic Effect of Shale Products" (1961). Studies in this area are continuing under his supervision, including collaboration with scientists in the USA.

Working out of problems of the epidemiology of cancer began for the first time in the republic upon the initiative of P.A. Bogovskiy. At present, the institute is the coordination center on the epidemiology of breast cancer in the USSR and conducts joint studies with the USA. One of the first cancer registers in the USSR was established at the site of the Republican Tallin Oncological Dispensary.

Pavel Aleksandrovich did important scientific and organization work at the International Agency for the Study of Cancer which he headed (in 1968-1974) the department of environmental carcinogens. He conducted research on experimental carcinogenesis and participated in expeditions in Iran for the study of the epidemiology of cancer of the esophagus. He instituted a series of publications of MAIR [International Agency for the Study of Cancer] on standardization of analytical methods for chemical carcinogens. Three volumes have been published already on methods of determining nitrose compounds of vinylchloride and polycyclic aromatic hydrocarbons. Upon Bogovskiy's initiative, the MAIR began to conduct international bi-annual conferences on problems of the formation and analysis of nitrose compounds, which stimulated coordination work for researchers of different specialties. Materials from these conferences are published regularly. Pavel Aleksandrovich also organized (at the institute headed by him and at Tallin Polytechnical Institute) studies of nitrose compounds and, at present, these institutions are the leading institutions in the USSR in this specialty.

Professor P. A. Bogovskiy continues to maintain close ties with MAIR and is presently a member of its scientific council and editorial board. He is Chairman of the Commission on Nitrose Amines as part of the section of the Scientific and Technical Council at the State Committee on Science and Technology of the USSR Council of Ministers, a member of the Committee on Carcinogenic Substances and Measures of Prophylaxis of the GSEU [Sanitary and Epidemiological Administration] of MZ [Ministry of Health] USSR, of the Scientific Council on Cancer of the USSR Academy of Medical Sciences and a member of the board of the All-Union Scientific Society of Oncologists.

P.A. Bogovski is the author of more than 120 works. He did much for the development of medical science and the training of scientists of the Estonian SSR. For several years, he has served as chairman of the UMS [Educational Methodological Council] of the ESSR MZ. He has supervised the preparation of several candidate's dissertations. He has been a consultant and an opponent in several doctoral studies. He has provided great service to the development of Estonian medical terminology and to editorial activities.

As a Communist, he participates actively in public life. In 1963-1967, he was deputy of the ESSR Supreme Soviet. As a member of the society "Znaniye" he frequently appears before large audiences. He has been awarded the Order of Lenin and several medals.

We wish him good health and great creative successes.

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## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

UDC 633.88+502.75 (47+57) (0.61.3)

### REPORT FROM CONFERENCE ON EFFICIENT USE OF MEDICINAL PLANTS

Leningrad RASTITEL'NYYE RESURSY in Russian No 2, 1979 pp 311-312

[Report on all-union scientific and technical conference, "Efficient Utilization and Protection of Medicinal Plant Resources," held in Krasnogorsk, Moscow Oblast, 24-25 October 1978, by O. L. Savel'yev, P. D. Sokolov and V. S. Sinitskiy, Soyuzlekrasprom, Moscow, Botanical Institute imeni V. L. Komarov, USSR Academy of Sciences, Leningrad: "Chronicle"]

[Text] On 24 and 25 October 1978 at the Krasnogorsk plant for processing medicinal plant raw materials in a suburb of Moscow there was an all-union scientific and technical conference on the subject "Efficient Utilization and Protection of Medicinal Plant Resources." The conference was organized by the interdepartmental council for the study, efficient utilization and protection of plant resources of the USSR and the Soyuzlekrasprom industrial association of the USSR Ministry of the Medical Industry. Participating in its work were 130 people who represented ministries and departments that are engaged in procurements and utilization of medicinal plants, production organizations that gather and process them and also scientific research institutions that study these plants and work out problems related to their protection. At the conference, 31 papers were given and discussed.

Opening up the conference, the deputy minister of the USSR Ministry of the Medical Industry, A. I. Yakovlev, pointed out the fact that the need for medicinal plant raw material is constantly increasing but the task of providing it for enterprises of the medical industry and public health institutions has not been resolved. The volume of procurements and the suppliers of medicinal plant raw materials were earmarked by the decree of the USSR Council of Ministers of February 1977, "On Measures for Increasing Production, Procurements and Deliveries of Raw Material from Medicinal Plants in 1977-1980 for the Needs of Public Health and the Medical Industry." How this decree is being fulfilled and what ways exist for improving procurements of medical plants were questions to be settled at this conference.

Questions related to fuller satisfaction of the needs for medicinal plants and measures contributing to the resolution of this problem were elucidated in the paper of the chief of the Soyuzlekrasprom Association (Moscow), A. M. Zadorozhnyy. The papers of the following participants were devoted to the

state of affairs and shortcomings in the procurements and satisfaction of the needs of medical institutions for medicinal plants: the chief of Tsentrkooplekhtekhsyr'ye of the USSR Tsentrosoyuz, A. D. Agafonov; deputy chief of the Main Pharmaceutical Administration of the USSR Public Health (Moscow), V. P. Dolgopolov; deputy chief of the Main Administration of Food Products from Timber of the RSSR Ministry of the Timber Industry (Moscow), V. I. Markin; and the chairman of the Main Pharmaceutical Administration of the RSSR Ministry of Public Health (Moscow), L. I. Denisova.

These papers showed that the need for medicinal plant raw material is constantly increasing. In 1970 it amounted to 35,000 tons, in 1978--51,000 tons and in 1980 it reached 90,000 tons. The plans for procurements of medicinal raw materials are being fulfilled in terms of the volume of products, but the need for many kinds of medicinal plants (mountain tobacco, *Arnica montana*, L.; lilly of the valley, *Convallaria majalis* L.; spotted lady's thumb, *Polygonum persicaria* L.; valerian, *Valeriana officinalis* L.; red whortleberry, *Vaccinium vitis idaea* L.; bearberry, *Arctostaphylos uva ursi* L.; sea buckthorn, *Hippophae rhamnoides* L., and many others) is regularly unsatisfied. Procurements are planned with respect to volume and they are made by many organizations, but frequently without taking into account the actual possibilities. This leads to unnecessary competition among procurement organizations, the existence of a large number of poorly supplied receiving points for raw materials, harmfully excessive procurements of plants in individual regions, and so forth. It is necessary to improve the organization of procurements and to step up research work for revealing raw material resources of medicinal plants and developing measures for their efficient utilization which ensure the preservation and reproduction of industrial supplies of raw material. In keeping with agreements with Soyuzlekrasprom, work is being conducted for determining the supplies of raw materials from wild medicinal plants but the information is poorly utilized in the places where they are obtained. Tsentrosoyuz has raised the issue of creating in the country supplies of raw materials from medicinal plants to last for 2-3 years so that the satisfaction of the need for them will not depend on weather conditions of a particular year.

The deputy director of the All-Union Scientific Research Institute of Medicinal Plants (VILR, p/o VILR, Moscow Oblast), A. I. Brykin, discussed the main directions for research for finding resources that is being conducted in this head institution. The research deals mainly with revealing supplies of medicinal plants, primarily the most important and least widespread (*Santolina*, *Artemisia cina*, *Berg ex Poljak*; varieties of rose, *Rosa* L.; *rodiole* rose, *Rhodiola rosea* L., and others). It also deals with the time periods for restoring the supplies of plants after the procurement of raw materials, the development of measures for protecting medicinal plants and the creation of preserves as well as the drawing up of instructions for gathering and drying individual kinds of raw material. In all cases, a great deal of attention was devoted to methodological issues.

Papers were given at the conference by representatives of the Uzbek SSR Ministry of the Timber Industry, the Lithuanian Scientific Research Institute

of the Timber Industry, the Carpathian branch of the Ukrainian Scientific Research Institute of the Timber Industry, the Timber Institute of the Karelian branch of the USSR Academy of Sciences, the VILR, the Pyatigorsk and Tashkent Pharmaceutical Institutes, the Leningrad Chemical-Pharmaceutical Institute, the first Moscow and Kursk Medical Institutes, the Moscow Pharmaceutical School, the Central Siberian Botanical Garden of the Siberian branch of the USSR Academy of Sciences, the Institute of Biology of the Bashkir branch of the USSR Academy of Sciences, the Institute of Experimental Botany of the Belorussian SSR Academy of Sciences, Uzhgorod University, the central laboratory for protection of nature of the USSR Ministry of Agriculture and pharmaceutical administrations of Kalininskaya and Novosibirskaya Oblasts. They introduced information about procurements of medicinal raw material in individual regions of the country and the results of research for determining supplies and developing measures directed toward efficient utilization and preservation of supplies of raw materials from medicinal plants. They also gave suggestions for improving the planning and organization of procurements of raw material and made suggestions for organizing preserves for medicinal plants.

Materials from the conference will be published by the All-Union Scientific Research Institute of Medicinal Plants.

Participants in the conference were interested in the paper given by the director of the Krasnogorsk plant for processing medicinal plant raw material, V. Ye. Novikov, concerning the enterprise he is in charge of and they participated in an excursion through the plant. In 1978 the plant was 40 years old and at the present time it processes 5,500 tons of medicinal plants a year and produces 12.5 million rubles' worth of products. Each year the plant experiences difficulties because of the shortage of raw material from individual kinds of medicinal plants.

In conclusion, the conference adopted a resolution (recommendation) which summed up the results of the work that had been done and earmarked tasks for the near future for stepping up research and improving procurements of raw material from medicinal plants.

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TREATMENT OF OPEN FRACTURES OF THE FINGERS USING LASER RADIATION

Moscow KHIRURGIYA in Russian No 5, 1979 pp 99-100

[Article by Prof A. P. Kus'michev, Prof V. P. Okhotakiy, Doctor of Medical Science A. K. Polonskiy, L. L. Pavlyuchenko, NII [Scientific Research Institute] of Emergency Medicine imeni N. V. Sklifosovskiy]

[Text] Open fractures of the fingers are among the most severe injuries to the hand. Development of different types of osteosynthesis, antibiotic therapy and deferred surgical treatment of wounds have made it possible to achieve positive results in treating open fractures of the fingers. These results, however, are not completely satisfactory. According to T. N. Chudakov's data, the rate of unsatisfactory results in treatment of open fractures of the fingers is as high as 25 percent. One of the basic reasons for this is wound suppuration, which according to the data of many authors (Ye. A. Bogdanov, Z. F. Nel'sina, Ye. V. Usol'tseva) was noted in 4 to 32 percent of observations. We analyzed the results of 29 patients with open fractures of the fingers who were under treatment in the traumatology clinic of the NII of Emergency Medicine imeni N. V. Sklifosovskiy. The restorative operations on the bones and tendons of the patients of this group were performed during the process of primary surgical treatment by the traumatologists on duty. In 20.7 percent of these patients significant suppurative processes were noted in the process of treatment. The studies on use of laser radiation for treating infected wounds are well known (D. V. Voronkov, A. A. Gulyaev; Mester et al).

The present work reflects an experiment using laser radiation for treating open fractures of the fingers.

We performed restorative operations during the process of primary surgical treatment or during early deferred surgical treatment. The operations included osteosynthesis with fine metal wires, but the tendons of the flexor and extensor were sutured with tendon sutures. Flesh wounds were sutured with widely spaced sutures. In some observations free epidermatoplasty was used. Laser radiation of the wounds was performed during the postoperative period.

The source of laser radiation was an OKC-12-1 optic quantum generator for continuous coherent-pulsed radiation with a wave length of 6328 Å and an output of 15 mW at an operating current of 44 mA in the tube. The laser

beam was 5 mm in section at the output. A series of removable dispersing lenses made it possible to change the diameter of the ray from 5 to 20 mm. Using the system of lenses we achieved full and even irradiation of the finger wounds. The exposure to the irradiation was directly proportional to the square area of the wound and was from 30 seconds to 10 minutes.

Forty three patients with 59 open fractures of the phalanges of the fingers (42 infected fractures, 17 fractures combined with tendon injuries) were under observation. There 29 fractures of the ungual phalange, 9 of the middle and 21 of the basal. All these fractures were accompanied by displacement of fragments. Primary surgical treatment was performed in 31 patients; deferred in 28 patients. Osteosynthesis with metal wires was performed 59 times; tendon sutures of the extensor were applied in 11 observations and of the flexor, in 6. Free epidermatoplasty was employed in 4 observations.

Laser therapy began on the second day postoperatively and was conducted at one day intervals. It continued right up to the union of the fracture. Four hundred fifty two sessions of laser irradiation of wounds were conducted in 43 patients. Falling on the wound, the laser beam caused specific luminescence of it with a reflected red light. All the patients tolerated the laser therapy well, noting mild and pleasant heat in the region of the wound and a decrease in pain during the session. We did not note any negative influence of the laser therapy on the patients at the parameters of irradiation used in the treatment process.

The remote results were studied in 34 patients at periods of 6 months to 1 year. The results of treatment were evaluated using Ye. A. Bogdanov's well known classification. The result of treatment was good in 26 patients, satisfactory in 6, and unsatisfactory in 2. In studying the two observations in which the results of treatment were unsatisfactory (prolonged suppuration and necrosis of the soft tissues of the phalange) we came to the conclusion that this was related to the considerable severity of the traumatic injuries. Apparently such patients should be separated into a special group.

According to our data and the data of other authors (L. K. Katlap), the average period of wound healing with use of laser therapy was 12.6 days, while with treatment by the usual methods without laser therapy it is 17 days.

## Conclusions

1. The combined method of treating open fractures of the fingers which consists of osteosynthesis and use of laser therapy in the postoperative period shortens the period of wound healing.
2. Use of laser therapy in treating open fractures of the bones of the hand during the postoperative period makes it possible to reduce the frequency of development of wound suppuration.

3. Osteosynthesis using metal wires in open fractures of the bones of the fingers in combination with laser therapy can be used not only at emergency services but also in ambulatory clinics.

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EXPERIENCE IN SEASONAL ALTERNATIVE PREDICTION OF THE ABUNDANCE OF THE GREAT GERBIL *RHOMBOMYS OPIMUS* (RODENTIA, CRICETIDAE) IN POPULATIONS ON THE NORTH SHORE OF THE ARAL SEA.

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[Article by L. D. Dubyanskaya and M. A. Dubyanskiy, Central Asian Scientific Research Institute of Antiplagues, Alma-Ata]

[Text] It is demonstrated that within the limits of geographical populations of the region north of the Aral Sea, alternative prediction of the spring-fall increment in the abundance of the great gerbil by means of sequential statistical analysis using prediction tables, derived from predictors distributed in the order of their decreasing informativeness, may be successful. The weather and population characteristics for the preceding winter of prediction and early spring period are used as the predictors--the mean monthly temperature in March, the mean 10-day maximum of the reproductive intensity of the great gerbil in March-April, the frequency of northeast winds in January, the spring abundance of the great gerbil, its winter survival, and total precipitation in March and April.

If we are to arrive at an epizootological prediction and plan preventive measures, we would have to make a seasonal prediction of changes in the abundance of the great gerbil (*Rhombomys opimus*)--a plague agent vector in natural desert foci; however, the antiplague service does not as yet possess any sort of mathematical model with which to make such predictions. We attempted to create prediction tables with which to forecast, in early spring, whether or not a particular increment in the abundance of the great gerbil (for example, a 10% increase for a series of several years) would be exceeded in fall. For this purpose we used the method of placing observations in one of two possible classes (5). The method presupposes selection and tabulation of informative predictors (prognostic signs). The values of a sign covering a certain number of years (in the principal group) are broken down into classes (ranges). For each of these classes we compute the probability that

the value of the sign would fall within a given range on the condition of subsequent high (+) growth in abundance, and the probability that the value of the sign would fall within this range on the condition that low growth (-) subsequently occurs. The computed probabilities (frequencies) are subjected to a "smoothing" technique (by the method of the sliding mean) so as to minimize the effect of the range boundaries chosen on the prediction results. In this case we consider the probability for the given sign in four neighboring ranges. The weighted average is computed by the formula:

$$\bar{y}_3 = (y_1 + 2y_2 + 4y_3 + 2y_4 + y_5) : 10;$$

$$\bar{y}_4 = (y_2 + 2y_3 + 4y_4 + 2y_5 + y_6) : 10$$

and so on, where  $y_1$  is the first term of the series,  $y_2$  is the second term of the series,  $y_3$  is the third term of the series, and so on, and  $\bar{y}_3$  and  $\bar{y}_4$  are the "weighted average" terms of the series. To compute "smoothed" frequencies  $y_0$  and  $y_{-1}$  in ranges located beyond the boundary ranges, Gubler and Genkin (5) recommend the formulas:

$$\bar{y}_0 = (0 + 0 + 0 + 2y_1 + y_2) : 10;$$

$$\bar{y}_{-1} = (0 + 0 + 0 + 0 + y_1) : 10.$$

It is assumed that when the number of observations is increased, a certain number of sample terms would fall into these ranges.

Then we find the logarithm of the ratio of smoothed probabilities (when multiplied by 10 it is called the prediction coefficient, PC) and we determine informativeness ( $I$ )--the product of the prediction coefficient and half of the difference of the smoothed probabilities divided by 100. We find total informativeness of a sign by adding the informativeness values of the ranges (Table 1). The informativeness of a sign is thus defined here as the amount of difference its distributions exhibit in its differentiated states + and -. Obviously the greater the total informativeness is, the higher is the factor's predictive value, since the predictors are distributed in the table in order of decreasing informativeness, and the prediction is made by the method of sequential statistical analysis (2), and the process may be interrupted when any one of the signs attains a threshold value. The thresholds are determined by the formulas:

$$\text{threshold } A(+) = 10 \lg \frac{100 - a}{\beta}$$



(for a small increment in abundance) and

$$\text{threshold } B(-) = 10 \lg \frac{\alpha}{100 - \beta}$$

(for a small increment in abundance), where  $\alpha$  is the permissible percent of first-order error (prediction of a low abundance increment when in fact it is high), and  $\beta$  is the permissible percent of second-order errors (false prediction of a large increment when in fact the increment is low).

Prediction boils down to summing the prediction coefficients with plus signs and minus signs separately. As soon as one of the thresholds is attained or surpassed, the successive identification procedure is interrupted and one decision or the other is adopted depending on which of the thresholds is attained. If none of the thresholds is attained, the prediction is uncertain. The same prediction table could be used for a period of several years.

Table 1. Example of Computing Prediction Coefficients and Informativeness Ranges\*

(1) Диапазон		(2) Частота (число наблюдений)		(3) Вероятности, %		(4) Сглаженные вероятности, %		(5) Отношение сглаженных вероятностей ( $y$ )	(6) ПК $10 \lg y$	(7) $I$
(7) номер	(8) границы	+	-	+	-	+	-			
-1	-	0	0	0	0	1,3	0	-	-	-
0	0	0	0	0	0	3,9	2,5	1,5	+2	0,01
1	0,1-0,3	1	0	13	0	9,1	6,3	1,4	+1	0,01
2	0,4-0,6	1	2	13	25	14,0	13,9	1	-	-
3	0,7-0,9	1	1	13	13	17,6	12,8	1,3	+1	0,02
4	1,0-1,2	3	1	36	13	22,2	13,9	1,6	+2	0,08
5	1,3-1,5	1	0	13	0	16,3	12,4	1,3	+1	0,02
6	1,6-1,8	1	3	13	36	11,4	18,3	1:1,5	-2	0,07
7	1,9-2,1	0	1	0	13	3,9	12,4	1:3,2	-5	0,21
8	2,2-2,4	0	0	0	0	1,3	9,8	1:7,5	-9	0,38
9	2,5-2,7	0	0	0	0	0	0	-	-	-
(9)	Всего	8	8	101	102	101,0	102,3			0,80

\* Distribution of the sign "number of gerbils per one 'average' burrow in spring" in a Northern Aral population (from data in Table 3; plus sign means an increment greater than 110 percent, and a minus sign means an increment less than 110 percent).

Key:

- |   |  |
|---|--|
| 1. Ranges                               | 5. Ratio of smoothed probabilities ( $y$ ) |
| 2. Frequencies (number of observations) | 6. PC, $10 \lg y$                          |
| 3. Probabilities, percent               | 7. Number                                  |
| 4. Smoothed probabilities, percent      | 8. Boundaries                              |
|   | 9. Total                                   |

This system allows us to evaluate the integrated effect of several different factors on the abundance of the great gerbil--both factors external to the rodent populations and those depending upon animal density. The prediction table is checked out using a test group of years (data for these years are not used to compute figures for the table) as well with the principal group.

Our research is based on archival materials of the Aral Sea Antiplague Station for 1957-1977 (of this period, the last 4 years were the test group). We used general data on the abundance and reproduction of the great gerbil cited in issues of the "Aral Sea Antiplague Station Rodent Abundance Survey," averaged in relation to geographic populations--Ust'-Urt, North Aral, Aral-Karakum, Trans-Aral (along the Dar'yalyk-Takyr), and North Kyzyl-kum. Obviously these averaged data are fully representative of changes in great gerbil abundance within the limits of a particular geographic population, inasmuch as synchronous changes in abundance were noted in the overwhelming majority of the territory (according to data from the same archives). The abundance of the great gerbil was estimated from the number of animals per "average" burrow\* (the product of the average number of animals per burrow and the number of burrows inhabited), while reproduction intensity (RI) was estimated from the total number of embryos in 100 adult females. We also used data from meteorological stations--Zhanbike, Saksaul'skaya, Monsyr, Dzhusaly, and Kzyl-Orda.

The landscapes of the areas in which the populations are located as well as variations in abundance of the great gerbil are described in (4,10, etc). Therefore we will limit ourselves to computing some statistics necessary for comparative assessment of our prediction tables (Table 2).

The Aral-Karakum population is distinguished among other populations of the great gerbil exhibiting high abundance by intensive reproduction and smoothed seasonal fluctuations in abundance. A high animal abundance is also typical of the Ust'-Urt population. Other populations, especially the North Kyzyl-kum population, on the other hand, are typified by low and average abundance of the great gerbil and dramatic seasonal fluctuations.

Growth in abundance of the great gerbil from spring to summer varies dramatically from year to year. The nature of these variations is similar over a greater part of the territory of the North Aral.

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\* The test was introduced and utilized in issues of "Obzory chislennosti gryzunov Aralomorskoy protivochumnoy stantsii" (Sea of Aral Antiplague Station Rodent Abundance Survey) by S. N. Varshavskiy and M. N. Shilov, who compiled the reviews prior to 1965. Subsequent documents were compiled by I. Zh. Zhubanazarov following the same pattern. The article authors participated in collection of the materials in 1958-1966 beside the Ust'-Urt Plateau, on the Northern shore of the Sea of Aral, and in the Karakum Desert next to the Aral Sea.

Table 2. Arithmetic Means (and Standard Errors) of the Increment in Great Gerbil Abundance From Spring to Fall, and the Abundance Predictors (Numerator), and Total Informativeness of Predictors (Denominator) for Populations of the North Aral, as Determined From Mass Surveys of 1957-1973

(1) Показатели	Популяции (2)				
	(3) уст'-уртская	(4) северно-аральская	(5) аральско-каракумская	(6) западная	(7) северо-кызылкумская
(8) Прирост численности, %	144±20	145±31	109±15	117±20	245±35
(9) Предикторы:					
(10) 1. Число зверьков на 1 «среднюю» нору весной	1.8±0.3 2.33	1.1±0.1 0.80	1.5±0.1 2.02	1.0±0.1 0.97	0.6±0.1 0.43
(11) 2. Зимняя выживаемость, %	50±0.9 3.11	46±3.3 0.79	55±5.0 2.16	53±5.5 0.68	47±4.4 0.71
(12) 3. Среднедекадный максимум ИР в марте-апреле	357±36 1.80	433±28 1.82	508±19 0.28	405±20 0.68	481±15 0.57
(13) 4. Среднемесячная температура воздуха в марте, °C	-2.4 0.97	-3.4 1.97	-2.9 0	-0.3 0.73	-1.3 1.29
(14) 5. Сумма осадков за март и апрель, мм	30.8 1.39	26.0 0.28	33.3 1.54	33.6 0.83	36.5 2.27
(15) 6. Повторяемость ветра северо-восточного сектора горизонта в январе (в случаях)	—	49 1.46	49 1.31	52 1.04	—

Key:

- |  |   |
|--|---|
| 1. Characteristics                                       | 11. 2. Winter survival, percent   |
| 2. Populations   | 12. 3. Mean 10-day RI maximum in March-April  |
| 3. Ust'-Urt  | 13. 4. Mean monthly air temperature in March, °C  |
| 4. North Aral  | 14. 5. Total precipitation in March and April, mm   |
| 5. Aral-Karakum  | 15. 6. Frequency of winds from the northeastern sector of the horizon in January (individual cases) |
| 6. Trans-Aral  |   |
| 7. North Kyzyl-kum                                       |   |
| 8. Abundance increment, percent                          |   |
| 9. Predictors:   |   |
| 10. 1. Numbers of animals per "average" burrow in spring |   |

The highest spring-fall increment in the abundance of the great gerbil was observed in 1964 and in 1972 (up to 250 percent in the Karakum Desert by the Aral and beside the Ust'-Urt, and up to 400-600 percent in other populations). It was significant over a large part of the territory in 1957 and in 1973-1977. A small spring-fall increment in abundance was noted in 1958, 1966, and 1968.

We consider features of the ecology of the great gerbil in our choice of prediction signs. We know that winter in the life of gerbils of the North Aral is a time of decreasing abundance devoid of reproduction, with the

weakened part of the population obviously being eliminated; that the first reproductive cycle, which usually falls in March-April, is the most productive of the two or three possible per year; that in years of copious summer precipitation the great gerbil reproduces in summer and fall; that feed availability for these rodents improves dramatically in years of copious precipitation, and so on (3,11).

After computing the distributions of different characteristics of the great gerbil populations and the weather characteristics for winter and early spring, we selected six signs typified by good informativeness in relation to the spring-fall abundance increment. The median spring-fall increment in the abundance of the great gerbil in a series of several years served as the limiting value in our computations of the average (the arithmetic mean was less convenient in this case due to an asymmetrical distribution).

The following signs were collected: 1) Spring abundance, 2) winter survival, 3) mean 10-day reproductive intensity maximum in March-April, 4) mean monthly air temperature in March, 5) total precipitation in March and April, 6) frequency of winds from the northeast sector of the horizon in January (Table 2).

We found in our informativeness calculations that the ranges of positive and negative influence of most of the factors upon growth in great gerbil abundance were practically the same for all populations of the North Aral. Only the modules of the coefficients and the informativeness values varied. A large abundance increment is directly associated with reproductive intensity in the first reproductive cycle (and it is probable when the mean 10-day RI maximum in March-April is greater than 500 embryos per 100 females) and with moisture in early spring (more than 32 mm precipitation). The mechanisms and causes of such a correlation are obvious.

Correlation with the rest of the signs is inverse. Spring abundance and summer survival of the great gerbil influence the subsequent growth in its abundance, apparently through the mechanisms of population homeostasis.

The positive influence low temperatures in March have on the abundance increment can perhaps be explained by the fact that late reproduction is more favorable to great gerbil populations, since the probability of recurring cold spells that are lethal to reproducing animals is reduced. Prior to intense increases in the spring abundance of the great gerbil, the mean monthly temperature in March was often less than  $-4.5^{\circ}$  at the Ust'-Urt, below  $-1.5^{\circ}$  in the Trans-Aral and the North Kyzyl-kum, and within  $(-4.5)-(-9)^{\circ}$  on the north shore of the sea (Table 3).

Arranging the predictors in order of their decreasing total informativeness, we arrived at prediction tables for each of the five geographic populations of the North Aral listed above. In this case we found that for populations with a high and stable abundance (Aral-Karakum and Ust'-Urt), signs describing the condition of the population were the most informative in the prediction tables (Table 2). The prediction coefficients corresponding to some of the

Table 3. Table for Prediction of Increment in Great Gerbil Abundance From Spring to Fall in the North Aral Population (for Determining That the Increment Will be More (+) or Less (-) Than 110 Percent of the Spring Animal Abundance)

№	Предикторы (1)	(2) Диапазоны	(3) ПК
(4) 1	Среднемесячная температура воздуха в марте, °C	-11.9 -10.5 -10.4 -9.0 -8.9 -7.5 -7.4 -6.0 -5.9 -4.5 -4.4 -3.0 -2.9 -1.5 -1.4 -0 +0.1 +1.5 +1.6	-6 +3 +10 +8 +4 -1 -3 -5 -4 -2
(5) 2	Среднедекадный максимум ИР в апреле	<150 151-250 251-350 351-450 450-550 551-650 >651	-6 -5 -2 -2 0 +2 +10
(6) 3	Повторяемость северо-восточного ветра в январе (число случаев)	<45 46-55 56-65 66-75 76-85 86-95 >96	+5 +1 -1 -2 -3 -6 -8
(7) 4	Число песчанок на 1 «среднюю» нору весной	0 0.1-0.3 0.4-0.6 0.7-0.9 1.0-1.2 1.3-1.5 1.6-1.8 1.9-2.1 2.2-2.4	+2 +1 +1 +3 +1 +3 +5 +5 -9
(8) 5	Зимняя выживаемость, %	12-19 20-27 28-35 36-43 44-51 52-59 60-67 >68	+3 +3 +1 +1 +1 0 -1 -8
(9) 6	Сумма осадков за март и апрель, мм	0-6 6.1-14 14.1-22 22.1-30 30.1-38 38.1-46 >46.1	-3 -1 -1 0 +1 +1 +3

Key:

- |  |   |
|--|---|
| 1. Predictors                                | 6. Recurrence of northeast winds in January (number of cases) |
| 2. Ranges                                    | 7. Number of Gerbils per "average" burrow in spring           |
| 3. PC  | 8. Winter survival, percent                                   |
| 4. Mean monthly air temperature in March, °C | 9. Total precipitation in March and April, mm                 |
| 5. Mean 10-day RI maximum in April           |   |



ranges of these signs, mainly the boundary ranges, were so large that it was often possible to interrupt sequential analysis in the prediction process by the second or third sign. Weather characteristics following at the end of the table may not even be utilized in predictions for some years. Others (for example "air temperature in March" for the Aral-Karakum) did not even enter the table due to their lack of informativeness. In relation to populations with low abundance (North Kyzyl-kum), weather characteristics occupy the first places in the prediction tables (differences in abundance are statistically significant).

The reason for weak influence of meteorological factors, temperature in particular, on great gerbil abundance in the Aral-Karakum and the Ust'-Urt can apparently be found in the unusually favorable edaphic and topographic conditions of these places. Presence of tremendous numbers of deep, fully engineered burrows with their own microclimate (6), the hilly mesorelief, and the general location of burrow areas in depressions afford protection to the animals and their habitats from the unfavorable effects of weather, mainly from the cooling action of winds. Obviously, the direction of changes in animal abundance depends more on density of habitat occupation than on variations in meteorological conditions. The differences discovered in the informativeness of factors pertaining to populations with different abundance levels are in agreement with Naumov's ideas concerning the role of groups of factors influencing the dynamics of animal abundance.

As an example we present a prediction table for alternative prediction of the spring-fall increment of great gerbil abundance in the North Aral population (Tables 3, 4). The predictors are arranged in order of decreasing total informativeness.

To make a prediction with the table, we add prediction coefficients corresponding to the characteristics of the given spring, up to a threshold sum of +8 or -8. The adequacy of this threshold is evidenced by the results of retrospective prediction (Table 6): In 20 years, not once did the sum of coefficients for a wrong response achieve this threshold. The probabilities of first- and second-order errors were assumed to be equal,  $\alpha = \beta = 12.5$  percent. The prediction technique is demonstrated in Table 5.

The threshold was reached (+11). Thus an increment of more than 110 percent of the spring animal abundance can be expected by fall.

As we can see from Table 5, the prediction for 1974 may be made with just the use of two signs. Use of other predictors increases the dependability of the prediction (Table 6).

A check on the prediction table (Tables 6, 7), made with the principal and test groups of years, showed that when "+8" is chosen as the threshold the proportion of correct responses is 85 percent. The rest are uncertain responses. It was revealed empirically (Tables 4, 6) that an uncertain

Table 4. Date Used to Compile and Check Out Prediction Table for Increment in Great Gerbil Abundance From Spring to Fall in the North Aral Population

(1) Годы	(2) Прирост численности, %	(3) Предикторы					
		(4) среднемесячная температура воздуха в марте, °C	(5) среднедекадный максимум ИР в апреле	(6) показатель северо-восточного ветра в январе (число случаев)	(7) число песчанок на 1 «среднюю» нору весной	(8) зимняя выживаемость, %	(9) сумма осадков за март и апрель, мм
1957	227	-5,4	435	42	1,1	22	18,2
1958	101	-0,5	367	108	1,6	48	72,4
1959	138	-5,4	532	66	1,6	50	28,8
1960	91	-11,8	523	50	1,2	32	7,4
1961	150	-2,9	490	63	1,2	52	18,9
1962	115	+2,9	384	35	1,4	42	26,8
1963	60	-2,3	343	62	2,0	67	30,3
1964	266	-6,3	412	23	0,3	24	39,6
1965	—	-1,6	—	66	—	60	32,3
1966	106	+2,0	369	90	0,6	40	12,7
1967	66	-3,5	214	78	0,9	35	6,4
1968	106	-0,1	388	65	0,6	75	22,5
1969	144	-7,1	557	76	0,9	56	36,0
1970	82	-2,0	431	54	1,7	75	33,0
1971	60	-4,4	235	27	1,7	55	26,1
1972	490	-7,8	740	—	1,0	37	11,0
1973	300	-2,1	689	16	0,6	33	35,2
1974	144	-2,3	699	30	0,8	20	13,1
1975	242	-2,5	570	26	0,7	29	14,6
1976	333	-9,6	581	—	0,6	32	31,4
1977	252	+0,5	587	47	0,7	36	15,0

Key:

1. Year
2. Abundance increment, percent
3. Predictors
4. Mean monthly air temperature in March, °C
5. Mean 10-day RI maximum in April
6. Frequency of northeast winds in January (number of cases)
7. Number of gerbils per "average" burrow in spring
8. Winter survival, percent
9. Total precipitation in March and April, mm

Table 5. Derivation of a Prediction for 1974 (That the Increment Will be Greater Than 110 Percent (+) or Less Than 110 Percent (-) for the Spring Abundance of the Great Gerbil) in the North Aral Population

№	(1) Предиктор	(2) Значение	(3) Диапазон	(4) ПК	
				+	-
1	(5) Среднемесячная температура воздуха в марте (в °C)	2,3	-2,9 -1,5		3
2	Среднедекадный максимум ИР в апреле (6)	699	651	11	

Key:

1. Predictor
2. Value
3. Range
4. PC
5. Mean monthly air temperature in March (°C)
6. Mean 10-day RI maximum in April

Table 6. Results of Retrospective Prediction of Spring-Fall Increment in Great Gerbil Abundance in the North Aral Population (Using All of the Predictors of Table 3)

(1) Группа	(2) Год	(3) ПК		(4) Оценка прогноза
		+	-	
(7) Основная	1957	14	3	Правильный (5)
	1958	4	18	»
	1959	5	5	Неопределенный (6)
	1960	5	7	Правильный (5)
	1961	1	5	Неопределенный (6)
	1962	7	4	Правильный (5)
	1963	1	15	»
	1964	24	2	»
	1965	—	—	—
	1966	1	11	Правильный (5)
	1967	2	9	»
	1968	0	16	»
	1969	12	2	»
	1970	1	17	»
	1971	5	9	»
(8) Проверочная	1972	23	1	»
	1973	17	3	»
	1974	19	4	»
	1975	9	4	»
	1976	7	0	»
	1977	5	5	Неопределенный (6)

Key:

- |                          |              |
|--------------------------|--------------|
| 1. Group                 | 5. Correct   |
| 2. Year                  | 6. Uncertain |
| 3. PC                    | 7. Principal |
| 4. Prediction assessment | 8. Test      |

Table 7. Result of Checking Prediction Table

(1) Группы	(2) число лет	(3) Ответы (в %)		
		(4) правильные	(5) ошибочные	(6) неопределенные
(7) Проверочная	4	75	—	25
(8) Основная	16	87	—	13
(9) Обе вместе	20	85	—	15

Key:

- |                      |              |
|----------------------|--------------|
| 1. Group             | 5. Wrong     |
| 2. Number of Years   | 6. Uncertain |
| 3. Results (percent) | 7. Test      |
| 4. Correct           | 8. Principal |
|                      | 9. Both      |

prediction often accompanies cases of a forthcoming average abundance increment (coupled with insignificant deviations from the median). This circumstance will help us to reduce the proportion of uncertain responses in the future. It would be interesting to note that it is precisely in years of a very high or a very low abundance increment that the overshoot of the corresponding sums of coefficients is overwhelming. Consequently we can to a certain extent judge quantitative deviations from the median abundance increment on the basis of the ratio of sums with different signs. There is also another way to make the prediction quantitatively more accurate--compiling a series of tables for different alternatives. Other ways for improving the prediction tables include selecting new predictors and "correcting" the sign distributions as more years of observations are accumulated.

Thus far we have discussed the question of predicting the fall abundance of the great gerbil in spring. There are also some grounds for predicting spring abundance--air temperature and precipitation in December. The colder December is, the colder is March (7); consequently winter is also longer and it is harder for the animals to survive the winter. Computations using data from the Saksaul'skaya Meteorological Station show that following a December with a mean monthly air temperature below  $-14^{\circ}$ , less than 40 percent of the North Aral great gerbil population survives the winter. A dry December (less than 8 mm precipitation) is favorable to animal winter survival. Data on animal abundance, for example on the trends in the change in abundance from the previous fall to the next fall, are also adequately informative. Many years of data on the abundance of predators that noticeably influence the abundance of the great gerbil in winter, data on the condition of feed for gerbils, and data on other possible biotic limiting factors of great gerbil abundance (3) could serve as the grounds for deriving prediction tables for winter survival of the great gerbil.

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